GOVERNMENT OF INDIA
EARTH SCIENCES
LOK SABHA

UNSTARRED QUESTION NO:2901
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Progress in Earth Sciences
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Will the Minister of EARTH SCIENCES be pleased to state:

(a) the progress made in the field of Earth Sciences during the last three years and the current year;

(b) whether the Government is satisfied with the achievements made in the said field;

(c) If so, the details thereof;

(d) If not, the reasons therefor; and

(e) the steps taken by the Government in this regard?

Answer

THE MINISTER OF STATE FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND MINISTRY OF EARTH SCIENCES
(SHRI Y. S. CHOWDARY)

(a) The mandate of the Ministry of Earth Sciences (MoES) is to provide services for weather, climate, ocean and coastal state, hydrology, seismology and natural hazards; to explore marine living and nonliving resources in a sustainable way and to explore the three polar regions (Arctic, Antarctic and Himalayas). To achieve this mandate, the research & development and operational activities of MoES are carried out under the following five major programs:

1. Atmosphere and Climate Research − Modelling, Observing Systems and Services (ACROSS).
2. Ocean Services, Technology, Observations, Resources, Modelling and Science (OSTORMS).
3. Polar and Cryosphere Research (PACER).
4. Seismology and Geosciences (SAGE).
5. Research, Education, Outreach and Training (REACHOUT).

The progress and details of these schemes during the above period are as follows:

(i) ACROSS:

â€¢ Augmentation of surface and upper air observational network and Doppler Weather Radar (DWR) Network. Better quality and high resolution digital data from INSAT-3D satellite and other satellites. Establishment of High Performance Computing System with 1.2 Petaflop speed to meet the modelling requirements.
â€¢ Under the National Monsoon Mission, a high resolution global deterministic weather prediction model has been commissioned for generating operational weather forecasts at a horizontal resolution of 12 km. With this, MoES has attained the same capability as in USA in using high resolution weather prediction models. Many major improvements have been made in data assimilation for the ingestion of data from the Indian and International satellites in numerical models.
â€¢ Development of first version of Earth System Model (ESM) with good fidelity in simulating the present climate and its variability. The ESM will be the first climate model from India to contribute to the forthcoming sixth Intergovernmental Panel on Climate Change (IPCC) climate change assessment process.
â€¢ Expansion of Agro-meteorological Advisory Services. Presently around 21.6 million farmers are directly benefitted by this service.
â€¢ Noteworthy improvement was made in track and intensity forecast of the tropical cyclones (24 hour forecast error in track prediction reduced from 141 km to 97 km and Landfall error from 99 km to 56 km during 2006 to 2015). Accurate forecasts of the recent cyclones, Phailin, HudHud and Vardah saved thousands of human lives.
â€¢ Noticeable improvements achieved in skills of Heavy Rainfall Forecasts (False Alarm Rate reduced from 46% to 11% and Probability of Detection increased from 49% to 67% from 2002 to 2015). For the first time in 2016, forecasts on different time scales during the hot weather season (April to May) including heat waves were issued by the India Meteorological Department.
â€¢ Many observational campaigns have been taken up as special atmospheric observations help us to understand model deficiencies and to improve the models. A large-scale joint India UK observational campaign was carried out during the period June-July 2016, which involved the deployment of UK's BAe-146- 301 atmospheric research aircraft with sophisticated scientific instruments and India's Sagar Nidhi and Sindhu Sadhna research ships.

â€¢ An observational campaign to understand different physical features of Fog and factors responsible for its genesis, intensity and duration was initiated during December 2016 at the Indira Gandhi International Airport (IGIA) and at Indian Council of Agricultural

Research (ICAR)- Indian Agricultural Research Institute (IARI) in New Delhi. These observations will be useful for improving model forecasts.
â€¢ A High Altitude Cloud Physics Laboratory with a complete range of the observational system has been set-up at Mahabaleshwar and Munnar to study the interaction of clouds with other environmental parameters through continuous observations inside the clouds at high altitude.
â€¢ The System of Air Quality and Weather Forecasting And Research (SAFAR) system has been developed and deployed at Delhi, Pune, Mumbai and Ahmedabad and an Air Quality Forecasting Model has been set up for four cities to forecast the air quality of various pollutants along with weather parameters with a lead time of 1-3 days.

(ii) OSTORMS

â€¢ Augmentation of Ocean Observing Systems in the Indian Ocean through national and international efforts. Provided a suite of advisory services on 24x7 basis, such as Tsunami early earning, Potential Fishing Zone, Ocean State forecast, coral bleach alert to cater to various sectors.
â€¢ The Ocean State Forecast service has been extended for neighbouring countries, Seychelles and Sri Lanka for providing 3- day forecasts on winds, waves, currents, temperature.
â€¢ Launching of International Indian Ocean Expedition-2 (IIOE-2) towards promotion of ocean science in the Indian Ocean Region.
â€¢ Operationalization of International Training Centre for Operational Oceanography at Hyderabad.
â€¢ The Search and Rescue Aid Tool (SARAT) was dedicated to the Nation It was used to provide Search and Rescue support to all the concerned in connection with the missing AN 32 aircraft, which was reportedly missing off Chennai on 22 July 2016.
â€¢ The online oil spill advisory module has been further updated to facilitate the indication of eco-sensitive zones, potential fishing zones, fishing avoidance zone during the event of oil spill.
â€¢ Deployment of Arctic Ocean Observing system was completed.
â€¢ Indigenously developed 500 m depth rated shallow water/Polar Remotely Operated Vehicle (PROVe). It was successfully deployed in the Andaman coral Islands and the vehicle was successfully maneuvered in the undulating reef terrain to record high quality underwater visuals of coral reef biodiversity with spectral irradiance.

â€¢ Developed backward bent ducted buoy to generate power from sea waves, drifter buoy, deep ocean bottom pressure recorder, and autonomous passive acoustic monitoring system.
â€¢ Beach nourishment technique was demonstrated at Pondicherry coast leading to gain of 60 m wide beach.
â€¢ 65% of deep water topographic surveys of Exclusive Economic Zone beyond 500 m water depth were completed.
â€¢ MoES signed a 15-year contract with the International Seabed Authority (ISA), for exploration of PolyMetallic Sulphides (PMS) in Indian Ocean.
â€¢ India became a member of the International Energy Agency Ocean Energy Systems (IEA-OES) through signing of the Implementing Agreement. By becoming a member of the IEAOES, India will have access to advanced R&D teams and technologies across the world.

(iii) PACER

â€¢ Established a high altitude research station in Himalaya called HIMANSH at a remote region in Spiti, Himachal Pradesh.
â€¢ Deployed India's first multi-sensor moored sub-surface observatory (IndARC) at a water depth of ~180 m in the Arctic.
â€¢ India successfully commenced operations at the 3rd Indian Permanent Research Station Bharati, at Larsemann Hills, East Antarctica. Three (34th, 35th and 36th) Indian Scientific expeditions to Antarctica were launched and executed successfully.
â€¢ India has been accorded the Observer status in the Arctic Council in recognition of her scientific contributions endeavors in Polar research.
â€¢ Research studies were carried out on variability of Cryosphere using remote sensed data, southern Indian Ocean and past climate and oceanic variability of Polar Regions.

(iv) SAGE
â€¢ Setting up of the National Centre for Seismology (NCS) at New Delhi to provide added thrust to seismological services in the country.
â€¢ Strengthening of the Seismic Observational Network: NCS now has 84 national observatories with real time data streaming through VSAT connectivity.
â€¢ VSAT communication facilities to additional 50 seismic stations as well as 30 GPS stations in the country under the Indian Seismic and GNSS (Global Navigation Satellite System) Network (ISGN). With the current seismic network, and data centers, an earthquake of M>3 anywhere in the country can be located in 3-5 minutes.

â€¢ The Scientific Deep Drilling Project at Koyna, Maharashtra started in 2016 with the aim of setting up of borehole observatory at 3.0 to 5.0 km depths for directly measuring parameters in the near field of earthquakes - before, during and after their occurrence. The pilot borehole has reached to a depth of 3 km.
â€¢ Setting up of Multi-Parameter Geophysical Observatories at Ghuttu, in NW Himalaya and Imphal in NE region to monitor various geophysical, geochemical and seismological precursory signals.
â€¢ Launching of a facility for Geochronology with an objective to generate high-quality geo-chronological data and its characterization.
â€¢ For the first time, Deep Sea Drilling in the Laxmi Basin enabled scientists to collect more than 1700m long sediment cores from the Eastern Arabian Sea to understand possible tectono-climatic link.
â€¢ First time successful deployments of Ocean Bottom Seismometers in the Indian Ocean Geoidal Low region to understand possible deep seated sources for remarkable geoid anomaly in the Indian Ocean.

(v) REACHOUT

â€¢ Under this program, Ministry has supported 55 focused research projects in the area of Atmospheric Science and Geoscience during the last 3 years and current year.
â€¢ As human resource development and capacity building, the ministry has supported the following: M.Tech/Ph.D. programme by sponsorship 5 M.Tech and 5 PhD students in Atmospheric-Oceanic Sciences & Technology at IIT Delhi , User-oriented M.Tech. programme on Ocean technology at IIT Madras 2 year M.Sc. course in Ocean & Atmospheric Sciences in University of Hyderabad.
â€¢ Established MoES Chairs at IIT Delhi, IIT Kanpur, IIT Kharagpur, IIT Gandhinagar. Following specialized lab facilities have also been set-up as National Facilities for use by researchers:

(a) Accelerator Mass Spectrometry (AMS) Measurement facility for 14C at Inter-University Accelerator Centre, New Delhi.
(b) Laser Heating Diamond Anvil Cell at Indian Institute of Science Education and Research (IISER) Kolkata.
(c) Laser Raman Spectrometer at National Center for Earth Science Studies (NCESS), Trivandrum.

â€¢ Three Earth Science and Technology Cells (ESTC) have been established in various universities for conducting research in different specialized areas of marine and atmospheric sciences during the last 3 years as follows:
â€¢ Marine Coastal Ecology of west Coast of India at M.K. Bhavnagar University.
â€¢ Satellite Meteorology at SRM University Katanklathur, Chennai (SRMU), Tamilnadu.
â€¢ Coastal and Ocean Technology at NITK, Surathkal, Mangalore, Karnataka Successful international cooperation with different countries for collaborative research and human resources development.

(b) & (c) Yes, Madam. The quality of weather services by the Ministry has shown appreciable improvements during the past 3 years. The loss of lives during the last 3 years sue to tropical cyclones has reduced to less than hundred as compared to the thousands during the previous decade. For example, the famous 1999 Super Cyclone in Orissa killed more than 10,000 people while the same intense Phailin claimed only less than 20 people in Orissa. This large reduction in casualties is attributed to substantial improvement in monitoring and prediction of tropical cyclones.

MoES for the first time started issuing forecasts for heat waves over the country. The heat wave forecasts issued during the 2016 hot weather season (April to May) were very successful. A few state governments like Gujarat, Andhra Pradesh, Maharastra and Odisha have initiated state actions plans based on these forecasts during the hot weather season, which could help them to warn people in advance about the occurrence of heat waves and thus saving their lives.

The third party assessment by the National Council if Applied Economic Research (NCAER) on the Agro-meteorological Advisory Services provided by the India Meteorological Department concluded that the annual economic benefit for the farmers cultivating 4 principal crops (Wheat, Rice, Sugarcane and Cotton) was Rs. 42,000 Crore in 2015.

The Indian National Centre for Ocean Information Services (INCOIS) provides PFZ advisories to 2.75 lakh fisherman on a daily basis to help them to easily locate the areas of abundant fish in the ocean. As per the 2015 report of NCAER, the Fishermen in the country made an annual profit of Rs. 3000 crores from these PFZ advisories and the cumulative economic benefits exceeding Rs. 370000 crores have been accrued from these ocean forecasts.

Ocean State Forecasts (forecasts of waves, currents, sea surface temperature, etc.) to fisher folk, shipping industry, oil and natural gas industry. Navy, Coast Guard and other stakeholders have improved considerably during the last 3 years. Oil spill advisories are being provided to facilitate the indication of eco-sensitive zones, potential fishing zones, fishing avoidance zone during the event of oil spill. About 16.5 lakh users are currently receiving the OSF.

(d-e) Does not arise.